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we see actually done in sunlight; and thus whoever can, without altering the quantity, effect this change in the quality of the radiation from gas, will add millions to the national wealth.

S. P. LANGLEY.

THE NEW-YORK AGRICULTURAL EXPERIMENT-STATION.

THE weekly bulletins of the New-York experiment-station, although "intended to inform the public of progress at the station rather than to give complete results," nevertheless contain some matters of interest.

Seeds.—A series of weighings on light and dark colored seeds of several kinds showed, that, in every case, a hundred dark-colored seeds were heavier than the same number of light-colored seeds. The dark-colored seeds were also found to contain a larger percentage of seeds capable of germination. Sprouting-trials with onion-seed of different ages indicated that seed over two years old is of little value. Confirmation was obtained of the results of Will on the germination of seeds, reported on p. 176 of SCIENCE. Out of a hundred kernels of corn, eight germinated for the fifth time after drying in the air. Both field-experiments and sprouting-trials showed a decided superiority, as seed, of corn taken from the tips of the ears over that taken from the butts or the middle.

Potato-culture.—The terminal eyes of the potato were found to germinate more promptly and vigorously than the basal eyes. The best crops were obtained, and at the least expense of seed, by cutting the potatoes to single eyes, and so cutting them that each eye retained a portion of the tuber extending as far as possible towards the central axis. Each eye may be regarded as the terminal bud of a branch extending from the central stem; and the potato should be so cut that each bud may retain all, or nearly all, of its branch. The conditions favoring the production of potatoes seem to be moisture and coolness for the roots, and warmth and dryness for the tubers. Culture which supplied these conditions, such as ridge-culture, and, still more, covering the seed-potatoes with four or six inches of sand, gave a large increase over level culture.

Root-development.—By excavation and washing, the development of the roots of several species of plants has been traced. Corn seemed to have two systems of roots,—one of fibrous roots, developing chiefly in the upper and warmer layers of the soil; and the other of coarser roots, passing downward into the subsoil. The hypothesis is advanced, that the former system serves mainly to supply the plant with ash ingredients, and the latter with water, and perhaps nitrogen. Wheat and potatoes appear to be deep feeders, developing their roots more abundantly in the lower and cooler layers of the soil. Tobacco, on the other hand, is a shallow feeder, like corn.

Feeding-experiments.—A single determination of the digestibility of corn-ensilage gave the following percentage results:—

Proteine	51.89
Fat	79.17
Crude fibre	60.91
Nitrogen free extract	67.59

The figures for proteine particularly are lower than those given in Kühn's tables of digestibility; and the conclusion is drawn, that the process of ensilage has decreased the digestibility of this in-

gredient. The conclusion is, however, entirely unwarranted; for the figures simply show that the ensilage was less digestible than Kühn's corn-fodder, but show nothing whatever about the digestibility of the corn-fodder of which this ensilage was made.

A series of feeding-experiments on milk-cows was carried out, the fat in the milk being determined chemically, while, at the same time, the butter obtainable from it was determined by actual churning. The interesting result was reached, that, with different rations, the amount of butter fluctuated much more than that of the total fat: in other words, the feeding seemed to make a difference in the completeness with which the butter could be extracted from the milk. A ration of shorts and hay gave the best results in this regard. Other interesting minor results were obtained, but the main object of the investigation is not very apparent from the account given in these bulletins. The coarse fodder was eaten *ad libitum*, the amount of water drunk was not regulated, and no sufficient data are here presented for a comparison of the different rations. It is to be presumed, however, that some of these deficiencies will be supplied in the formal report of the station.

An analysis of the milk of fatigued cows showed that it was quite phenomenal in character, the total solids being nearly a third greater than the normal amount, and the increase being nearly all in the fat.

H. P. ARMSBY.

CLASSIFICATION OF ISLANDS.

A. KIRCHHOFF (*Kettler's zeitschr. wissenschaft. geogr.*, iii. 169) presents some criticisms on Peschel's and Wallace's work in this direction, and proposes the following table. A, Festländische Inseln: a, Abgliederungsinseln; b, Restinseln. B, Ursprüngliche Inseln: a, Submarin eustandene vulkanische Inseln; b, Aufschüttungsinseln; c, Nichtvulkanische hebungsin-seln. The first group includes those derived from a continental land-mass, either by submergence or seashore erosion, the latter being uncommon. Its first subdivision (dismemberment-islands?) are found along the borders of existing continents, and are very numerous. The second subdivision (remnant-islands?) would include the last surviving summits of a drowned continent; but no examples are surely known, unless those of the Antarctic Ocean belong here. These continental islands might be of volcanic rocks, for the higher points of many existing continental districts are of volcanic origin: they are not necessarily of varied geological structure, as described by Wallace. Witness the monotonous low quaternary islands along the German seacoast. And, while it is true that land mammalia and amphibia are wanting on islands of the second group, it is an error to say, with Wallace, that they are always present on those of the first. Wallace recognizes that elevation, after a complete though short submergence, would reveal the island bereft of its earlier continental fauna, but finds no examples of such a result. Kirchhoff adduces the Halligen Islands of the North Frisian group as such examples; for their low surface is frequently submerged by high winter tides, leaving only the huts crowded on artificial mounds above water. They have no mammals (except the domestic); moles are unknown in their green meadows; nor have they toads or frogs. Larger examples of the first group are seen in Greenland and the archipelago north of British America; in the West Indies, once connected with South America, Florida being of comparatively modern extension towards Cuba; New Guinea; and Borneo.

Madagascar and New Zealand are of older separation, the latter approaching the *restinseln*.

The term 'oceanic' is discarded for the second group, because islands may be formed *de novo* close to continental shores; but the term proposed ('original') is not altogether satisfactory, as it does not express precisely what is meant. The first subdivision (volcanic islands) contains the most important examples, which have sometimes, from their considerable age and altitude, acquired peculiar and local organic forms. The second subdivision (heaped-up islands) includes those of coral and of sand, on which the dry surface is due to wave and wind action. These are all low and monotonous. The third subdivision includes portions of the sea-bottom laid bare by non-volcanic action, either by local elevation "or by withdrawal of the sea formerly held at a higher level by the local attraction of mountains or ice masses that have now disappeared." A single example of recent formation is given, — the so-called 'Gulf-stream island,' north-west of Novaya Zemlya, where the Dutch navigators of 1594 found a sand-bank in seventeen fathoms of water. Peschel's error of placing the Japanese and Philippine islands among the volcanic is corrected: they are included among the continental, as both contain a series of old non-volcanic rocks.

W. M. DAVIS.

LETTERS TO THE EDITOR.

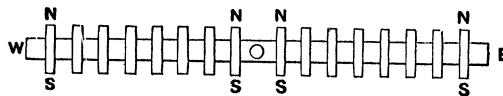
A new form of battery-cell.

IN the ordinary voltaic element, two solid plates are acted upon unequally by one or more liquids. About three years ago, it occurred to me to construct a battery-cell with three non-miscible liquid strata, and no solid plates; which I did, as follows: in a small beaker-glass I placed successively layers of mercury, dilute sulphuric acid, and a solution of iodine in ether. Upon connecting the uppermost and lowest layers with insulated wires, and introducing a coarse galvanometer into the circuit, I obtained evidence of a fairly strong current of electricity. Having neither time nor opportunity to pursue the matter further, I put it on record now in order that any student who happens to be interested in the subject may carry out the investigation. Theoretically, a three-liquid cell is interesting, because its internal resistance ought to diminish with rise of temperature. In this respect it might be very different from the usual voltaic elements. Possibly a combination of solid plates with the upper and lower liquids might give a cell having an internal resistance constant for varying temperatures. F. W. CLARKE.

Correcting compass deviation.

SOME years ago, frequently recurrent shipwrecks from magnetic disturbance in the Gulf of St. Lawrence directed my attention to the subject of improving the mariner's compass, or supplementing it in some way which would make its indications trustworthy. The causes of the shipwrecks which I have mentioned seemed to be deposits of iron ore near the shore, so extensive in their area as to render the compass-reading false and misleading. The problem of improving the compass is an important one; for, apart from such risks as those which beset navigation in the Gulf of St. Lawrence, the deviation on board ship due to the presence of iron in the structure or cargo of the vessel is an element of some uncertainty, and danger even, when all the devices known to the mariner's art are used to correct the readings.

My first attempt was to so dispose a series of small flat magnets, fastened across a strip of aluminum, that the strip as such, when poised at its centre, pointed east and west.



Poised concentrically with the strip at such a distance as to avoid mutual influence, I placed a light magnetic needle of a length equal to that of the strip. When strip and needle were near enough to a piece of iron to be attracted by it, one of the two acute angles formed by them indicated the position of the disturbing iron; and this inclination at an acute angle promised to be of value in solving the problem of correcting compass-readings. But magnetic influence on the large scale which prevails on shipboard proceeds from distant centres along large curves, in which terrestrial and local forces merge, which are not attractive, but simply directive; so that when I tried my device on a steamer under very favorable experimental circumstances, as the magnets, large and small, were directed into curves so great as to be practically straight lines, the needle and strip were always at right angles with each other. Were it feasible to use a very long magnetic strip at sea, my device might be available; but, so long as ships roll and pitch on the ocean's unruly surface, the dimensions of the ordinary compass must remain as they are. Since abandoning the fragile little model which I launched with some expectations long ago, I have frequently reverted to the problem it was intended to solve; and it has occurred to me, that were an electro-magnet poised so as to be in constant and free communication with a battery, and were it possible to make it, when desired, so intense in its power that its induction affecting the iron of ship or cargo should increase the deviation which, when less intensely excited, would affect it, then the direction of the deviation would be, of course, known by the direction of the increase of that deviation, and the problem of correcting the compass-reading would be advanced a step. The intensity of the electro-magnet would yield such results as a long (impracticably long) magnetic strip. The electro-magnet would require to be so constructed as to be capable of developing the utmost intensity possible; and the current sent through it should be controllable at will, so that the indications at moderate and highest intensity might be compared. I have neither the skill nor opportunity to carry out the suggestion here given, and publish it in the hope that some competent man of science may be able to embody it in a practical and useful form. GEORGE ILES.

Montreal, May 25, 1883.

MAINE'S EARLY LAW AND CUSTOM.

Dissertations on early law and custom. By Sir HENRY SUMNER MAINE, K.C.S.I., LL.D., F.R.S. New York, Henry Holt & Co., 1882. 402 p. 8°.

WHEN a new book by Sir Henry Maine is announced, we expect to have something to read worth reading. Nor have we ever been disappointed. The author of 'Ancient law' has always something interesting, suggestive,